

5 What is Claimed is:

1. A protein comprising an amino acid sequence that codes for a variant protein of the lovE protein having at least one mutation selected from the group consisting of:

- 10 (a) a Group 6 amino acid residue mutated to a Group 2 amino acid residue at position 31;
- (b) a Group 3 amino acid residue mutated to a Group 5 amino acid residue at position 41;
- (c) a Group 4 amino acid residue mutated to a Group 2 amino acid residue at position 52;
- 15 (d) a Group 4 amino acid residue mutated to a Group 3 amino acid residue at position 52;
- (e) a Group 4 amino acid residue mutated to a Group 5 amino acid residue at position 73;
- 20 (f) a Group 1 amino acid residue mutated to a Group 4 amino acid residue at position 101;
- (g) a Group 1 amino acid residue mutated to a Group 3 amino acid residue at position 101;
- (h) a valine amino acid residue mutated to another Group 2 amino acid residue at position 111;
- 25 (i) a Group 4 amino acid residue mutated to a Group 2 amino acid residue at position 133;
- (j) a Group 3 amino acid residue mutated to a Group 2 amino acid residue at position 141;
- 30 (k) a Group 3 amino acid residue mutated to a Group 5 amino acid residue at position 141;
- (l) a Group 4 amino acid residue mutated to Group 6 amino acid residue at position 153;
- (m) a Group 4 amino acid residue mutated to a Group 5 amino acid residue at position 153;
- 35 (n) a Group 4 amino acid residue mutated to a Group 1 amino acid residue at position 281;
- (o) a Group 3 amino acid residue mutated to a Group 2 amino acid residue at position 367;
- 40 (p) a Group 3 amino acid residue mutated to a Group 6 amino acid residue at position 367;
- (q) a Group 1 amino acid residue mutated to Group 4 amino acid residue at position 389; and

5           (r) a Group 1 amino acid residue mutated to a Group  
2 amino acid residue at position 389.

2. The protein of claim 1, wherein the variant protein  
has a Group 6 amino acid residue mutated to a Group 2  
10 amino acid residue at position 31.

3. The protein of claim 2 having the mutation F31L.

4. The protein of claim 1, wherein the variant protein  
15 has a Group 3 amino acid residue mutated to a Group 5  
amino acid residue at position 41.

5. The protein of claim 4 having the mutation Q41K or  
Q41R.

20 6. The protein of claim 1, wherein the variant protein  
has a Group 4 amino acid residue mutated to a Group 2  
amino acid residue at position 52.

25 7. The protein of claim 6 having the mutation T52I.

8. The protein of claim 1, wherein the variant protein  
has a Group 4 amino acid residue mutated to a Group 3  
amino acid residue at position 52.

30 9. The protein of claim 8 having the mutation T52N.

10. The protein of claim 1, wherein the variant protein  
has a Group 4 amino acid residue mutated to a Group 5  
35 amino acid residue at position 73.

11. The protein of claim 10 having the mutation C73R.

12. The protein of claim 1, wherein the variant protein  
40 has a Group 1 amino acid residue mutated to a Group 4  
amino acid residue at position 101.

13 The protein of claim 12 having the mutation P101S.

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14. The protein of claim 1, wherein the variant protein has Group 1 amino acid residue mutated to a Group 3 amino acid residue at position 101.

10 15. The protein of claim 14 having the mutation P101Q.

16. The protein of claim 1, wherein the variant protein has a valine amino acid residue mutated to another Group 2 amino acid residue at position 111.

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17. The protein of claim 16 having the mutation V111I.

18. The protein of claim 1, wherein the variant protein has a Group 4 amino acid residue mutated to a Group 2 amino acid residue at position 133.

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19. The protein of claim 18 having the mutation S133L.

20. The protein of claim 1, wherein the variant protein has Group 3 amino acid residue mutated to a Group 2 amino acid residue at position 141.

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21. The protein of claim 20 having the mutation E141V.

22. The protein of claim 1, wherein the variant protein has a Group 3 amino acid residue mutated to a Group 5 amino acid residue at position 141.

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23. The protein of claim 22 having the mutation E141K.

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24. The protein of claim 1, wherein the variant protein has a Group 4 amino acid residue mutated to Group 6 amino acid residue at position 153.

40 25. The protein of claim 24 having the mutation C153Y.